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TITLE	MTAPER - 8K MAGTAPE MONITOR (TRØ5-A INTERFACE) AND 8K FORTRAN I/O
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MTAPER - 8K MAGTAPE MONITOR (TRØ5-A INTERFACE)
AND 8K FORTRAN I/O

DECUS Program Library Write-up

DECUS NO. 8-653

Introduction:

In the course of chemical research, there arise certain problems that cannot be handled efficiently manually. Many of these problems are of a computational nature; such as, numerical integration of rate equations, which take highly skilled analysts days or weeks to solve in a single case.

Other problems involve the collection of data from experiments of a rather short duration (total observation time 1 second).

Such computational and observational problems can best be solved through the use of a computer.

This

computer is equipped with 8K of core storage, the extended arithmetic element, a teletype reader/punch, and a 9 track, 800 BPI magnetic tape drive. The magnetic tape drive is IBM 360/370 system compatible.

This computer system came only with software to handle the 8K of core and the teletype, therefore it was necessary to develop software to handle the magnetic tape drive.

Since the teletype is a very slow device with which to input program tapes, it was decided that a program was needed to store, retrieve, and upkeep programs on a magnetic tape volume. This program has been written and thoroughly

tested. It provides all the facilities necessary to maintain a program library. The Tape Monitor Program is controlled through the keyboard by a series of 4 commands:

1. Store a program.
2. Execute a program.
3. Delete a program.
- and 4. List programs residing on tape.

The monitor also notifies the user of any errors that occur, such as:

1. Improper input.
- and 2. existence of program on the tape volumn.

(For further information see the section "TAPE MONITOR PROGRAM")

Once the Tape Monitor Program was completed, it became evident that a means of storing and accessing data on the tape was necessary; since the teletype punch is much too slow to keep up with such Input Devices as an analog to digital converter and too awkward to be used to store the results of intermediate steps in complex calculations. It was therefore decided that the tape drive should be used as a storage device for several data files.

Since many people in the scientific community are familiar with Fortran IV, it was decided that this would be the best programming language for which to write program controlled tape I/O programs.

With relatively small exceptions, the tape drive was programmed as if it was like any other formatted I/O device. The Fortran I/O package for the tape drive is composed of programs and subroutines that rewind the tape, open data files, close data files, move the tape forward or reverse, and handle the formatted I/O. This I/O package is extremely fast and simple to use. Anyone with a rudimentary knowledge of Fortran can utilize the tape drive in a few minutes. (for further information see the section "Fortran Magnetic Tape I/O")

In the following sections are detailed descriptions of the Tape Monitor Program and the Fortran Tape I/O, with appendices giving a description of the Fortran Compiler and Operating system, program listings, for the Tape Monitor Program.

TAPE MONITOR PROGRAM

PDP - 8/e - TRØ5 - A INTERFACE

April 28, 1972

Introduction:

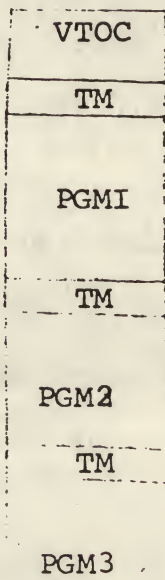
The TAPE MONITOR PROGRAM is a series of machine language programs designed to maintain a program library on an IBM 360/370 system compatible magnetic tape drive.

The main functions of the program are:

1. to STORE a program or data file onto the tape drive.
2. to EXECUTE a program, that is to read a program from the tape drive into the computer.
3. to DELETE a program from the tape drive.

Organization of the tape:

The magnetic tape is organized as follows:



VTOC is the volumn table of contents.

TM is a tape mark.

PGM1-PGMn are the programs as they reside on tape.

INITIALIZING the tape Drive:

1. Turn the computer on.
2. Check to see if the tape drive power is on, if it is not on, press POWER.
3. Press LOAD
4. Press LOAD a second time. Tape will commence to move forward until the load point is encountered, unless the tape reader is already beyond the load point then

press REWIND

5. Press On-Line

USING THE BOOTSTRAP LOADER:

When the computer is turned on the Tape Monitor Program does not reside in core. In order to load this program the Bootstrap Loader is needed.

1. Set switch register to 0001. Depress EXT D ADDR LOAD
2. Set switch register to 7777. Depress ADDR LOAD
3. Set teletype on-line
4. Load Bootstrap tape in reader
5. Depress Clear
Depress Continue
6. After the tape has read in, set switch register to 0011. Depress EXT D ADDR LOAD
7. Set switch register to 7600. Depress ADDR LOAD
8. Depress Clear
Depress Continue

The Tape Monitor Program has now been loaded into core and accessed.

UTILIZING THE MONITOR PROGRAM:

The bootstrap loader loads monitor into Field 1 of core..

STORING A PROGRAM:

1. Access the tape monitor program.
2. Enter an asterisk (*) from the keyboard.
3. Enter the name of the program to be stored;
a valid name is composed of five alphanumeric characters, the name cannot start with a blank, if the name is less than five characters long it must be padded to the right with blanks.
4. Enter the field from which the program is to be stored times ten, e.g. Field 1 is 0010.
5. Enter the starting location of the program in core, right justified.
6. Enter the final location of the program in core, right justified.
7. The program will halt at location 7667 Field 1.
8. Load the program to be stored in the usual manner.
9. Set the switch register to 0011
Depress EXTD ADDR LOAD
Set the switch register to 7670
Depress ADDR LOAD
Depress CLEAR
Depress CONTINUE.
10. After the program has been stored on the tape volume, the program halts. To reaccess the monitor press CONTINUE.

EXECUTING A PROGRAM:

1. Access the tape monitor program.
2. Enter a slash (/) from the keyboard.
3. Enter the program name as in step of storing a program.
4. Enter the field times ten into which the program is to be loaded.

5. Once the program is loaded, the monitor program halts. To reaccess the monitor, press CONTINUE.

DELETING A PROGRAM:

1. Access the monitor.
2. Enter a dollar sign (\$) from the keyboard.
3. Enter the name of the program to be deleted as in step 3 of storing a program.
4. Once a program has been deleted, control is returned to the monitor program.

LISTING THE VOLUMN TABLE OF CONTENTS (VTOC):

1. Access the monitor.
2. Enter an L from the keyboard.

The VTOC will be printed out as follows;

program name starting location negative value of the end location
The listing is terminated by an upward pointing arrow.

STORING A PROGRAM THAT FILLS 8K OF CORE:

1. Load the program to be stored in the usual manner.
2. Access the monitor.
3. Store the field 0 half of the program first. It is advisable when storing the program halves to use the same first four characters and for the field 0 half make the fifth character of the name a blank; for the field 1 half the fifth character should be a 1.
4. Press CONTINUE.
Press CONTINUE.
5. Enter the store command for the field 1 half of the program. The monitor program will halt.

6. Load the program again as in step 1.

7. Set the switch register to 0011

Depress EXT D ADDR LOAD

Set the switch register to 7670

Depress ADDR LOAD

Depress CLEAR

Depress CONTINUE

The program is now stored on the tape volume.

Examples:

8K Focal is stored as:

FOCLO for the field 0 half and

FOCL1 for the field 1 half.

ACCESSING 8K PROGRAMS:

1. Access the monitor.

2. Execute the field 0 half.

3. Press CONTINUE.

4. Execute the field 1 half.

The program is now loaded into core.

8K LIBRARY PROGRAMS:

program name	starting location	library names
FOCAL	200 field 0	FOCLO
		FOCL1
SABR Assembler	200 field 0	SABRO
		SABR1
FORTRAN Compiler	1000 field 1	FORTO
		FORT1
LINKING LOADER	200 field 1	LDDRO
		LDDR1

INITIALIZING A TAPE VOLUMN:

1. Load the binary tape for the tape monitor program into the teletype reader.
2. Set the switch register to 0001.
Depress EXTD ADDR LOAD.
Set the switch register to 7777.
Depress ADDR LOAD.
Depress CLEAR.
Depress CONTInue.
3. Once the binary tape has been read in the reader will halt.
4. Set the switch register to 0011
Depress EXTD ADDR LOAD.
5. Set the switch register to 4400
Depress ADDR LOAD.
6. Set the switch register to 3000
Lift the DEPOSIT switch
Depress CONTInue.
7. Enter from the keyboard:
* VTOC 0010 5000 6000
the program will halt.
Depress CONTInue.
The program will again halt.
8. Set the switch register to 3000
Depress ADDR LOAD
Depress CLEAR
Depress CONTInue.
9. Enter from the keyboard:
* VFLD1 0010 3000 7600
The program will halt.
Depress CONTInue.
The tape has now been initialized. To access the monitor
Depress CONTInue.

Fortran Magnetic Tape I/o

Introduction:

The magnetic tape device is what is commonly called a sequential mass storage device; this means that the tape drive can only access data sequentially. The sequential aspect of the tape drive makes the handling of the various I/o (input/output) very similar to those of the card reader, printer, or paper tape. The advantage of the tape drive over these other I/o devices is its superior speed of I/o and the huge amount of data it can store.

The magnetic tape may have several different files of data stored on it. To facilitate the retrieval of this data, each data file is terminated by an end of file (EOF) mark.

Accessing a Data File:

In the Fortran language a data file may be accessed through the use of the file opening routine, FGET. FGET is accessed in the following manner:

CALL FGET (n) ; where n is a positive integer of Fixed Point variable, whose value equals the physical number of the dataset on the tape volumn.

FGET may be called from anywhere in the program. If the tape is not at the BOT (Beginning of Tape), it will rewind to that point and move forward to the data set, [(n-1) tape marks away].

Formatted Tape I/o:

The magnetic tape drive has been assigned the I/o number of 2, e.g.

```
WRITE (2,100) X, Y, Z, I
100 FORMAT (3F10.4, I5) will cause this record to be output
on the tape drive.
```

READ (2,100) X, Y, Z, I will cause a record to be read from the tape drive.

Note: the maximum number of characters that can be output or input by the tape is 63_{10} .

Closing an Input File: An input file is closed by calling the subroutine RWD, e.g.

CALL RWD

This causes all Tape I/o to cease, the I/o Buffers to be emptied, and the tape to rewind.

Closing an output File:

An output file is closed by calling the subroutine CLOSE, e.g.

CALL CLOSE

This causes an EOF mark to be made on the tape, all I/o Buffers to be emptied, and the tape to rewind.

Use of the TAPE subroutine:

The TAPE subroutine is used to give commands to the tape drive, and test the resultant condition codes.

The TAPE subroutine is used

- 1) to rewind to the start of a currently opened file; this would be due to save time and cut down on tape motion.
- 2) to check the current status of the tape drive; this would mainly be used to debug programs.
- 3) to move forward to the start of the next data set, without rewinding to the beginning of the tape.

The subroutine is called as follows:

CALL TAPE (INST, IRSLT)

INST is an instruction to the tape drive; see the following table.

RSLT is the result, i.e. if no error condition was detected a zero; otherwise a number from 1-9 will be returned; see the following table.

Command Function	Decimal Value
No Operation	259
REWIND	267
* READ	275
* READ/COMPARE	283
* WRITE	291
WRITE EOF	299
SPACE FORWARD	307
SPACE REVERSE	315

* Note: It is strongly advised not to use these command functions with the tape subroutine, since the desired result will most likely not occur.

RESULT	Meaning
0	No Error
1	Tape Rewinding
2	Beginning of Tape
3	Illegal Command
4	Parity Error
5	End of File
6	End of Tape
7	Read/Compare Error
8	Record Length incorrect
9	Date Request late

Example of Tape Subroutine use:

REWINDING TO THE BEGINNING OF THE CURRENTLY OPENED FILE:

In order to rewind to the start of a currently opened file, the TAPE SUBROUTINE must be called:

CALL TAPE (315, IRSLT)

315 is the space reverse command.

IRSLT = 5, if the Date file is not the first on the tape column.

IRSLT = 2, if the Data File is the first on the tape
column.

Note: Except in this case, all files must be opened through
the use of FGET.

Compiling and loading a Fortran Program

1. Using either the teletype off-line or the Symbolic editor, the user must punch the Fortran source tape.
2. Load the Fortran IV compiler into core. (for this procedure see the section "ACCESSING 8K PROGRAMS")
3. Place the source tape in the reader.
Set the switch to start, turn on the punch.
4. Start the compiler at loc 1000 Field 1.
The compiler will punch out an identification and then an object tape in the SABR Assembler Language.
5. When the compiler has stopped punching out tape, load the bootstrap into core.
6. Load the SABR compiler into core.
(see the section "ACCESSING 8K PROGRAMS")
7. Place the Fortran Output into the reader.
Set the switch to start.
8. Start the compiler at loc. 200 Field 0.
The compiler will punch out an identification and then the question:

HIGH SPEED READER?
Enter an ~~x~~^{ct} from the teletype.
The compiler will then print HI, immediately turn on the punch.

9. The compiler will read the tape through, and pause;
place the tape at the beginning again and press
continue.
10. Remove the object tape and turn off the punch.
11. If the program compiled is a function or subroutine,
wait until a main program has been compiled before
proceeding to the following steps.
12. Load the Linking Loader into core.
(See the section "ACCESSING 8K PROGRAMS")
13. Place the Fortran main program in the reader, turn
the reader on.
14. Set the switch register to 0011
Depress EXT D ADDR LOAD
Set the switch register to 0200
Depress clear
Depress continue
15. After the first tape has been loaded the programs
stop. Follow with the remaining Fortran subroutines
and functions. Depressing continue each time a tape
is ready to be read.*

* Note: tape must be ready in reader before pressing
continue
16. Following the Fortran Object tapes, the tape #1 of the
Fortran subroutine library should be loaded.

17. If Exponentials, trigonometric functions, sub-scripting, logarithms, square roots, and specialized tape I/O functions are needed they should be now loaded into core.
18. If the number of free pages in core is desired set switch Ø to 1 and press continue.
If the a map of core is desired set switch 1 to 1 and press continue.
If the current field is full, set switches 10-12 .. to the desired field for loading.
19. The Fortran program is now properly loaded into core. Its starting address is found in the map of core obtained from the linking Loader.

Further information on the Fortran, SABR, and Linking Loader may be found in the Digital Equipment Corp. publication, "Programming Languages, PDP-8 Family Computers."